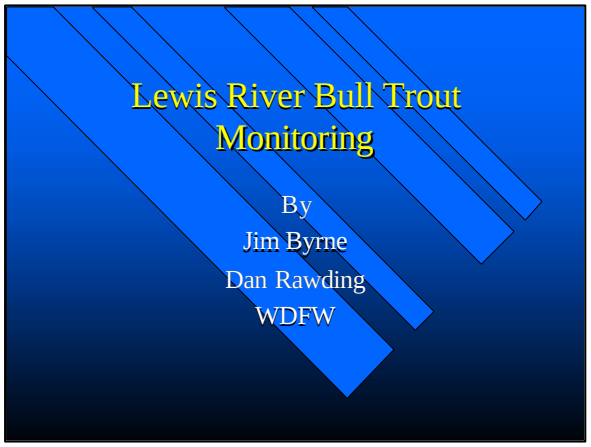
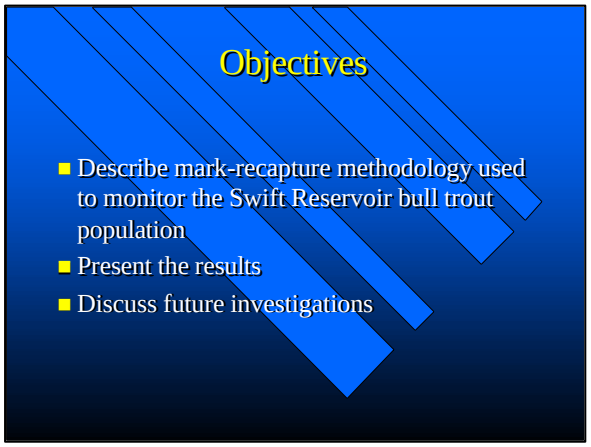


Figure 1

Figure 2



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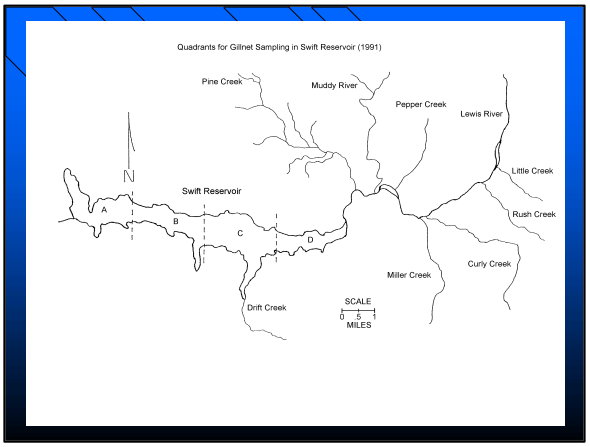

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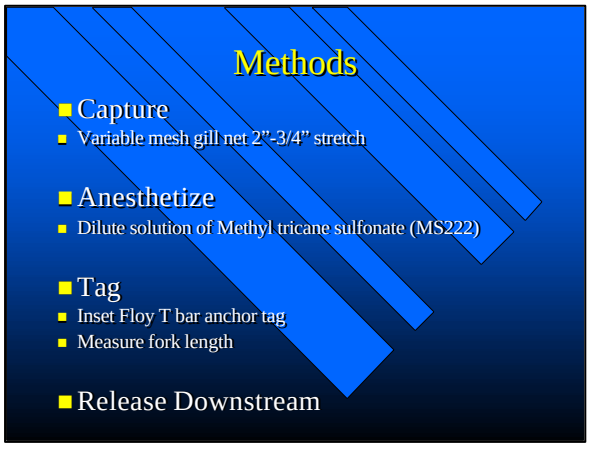

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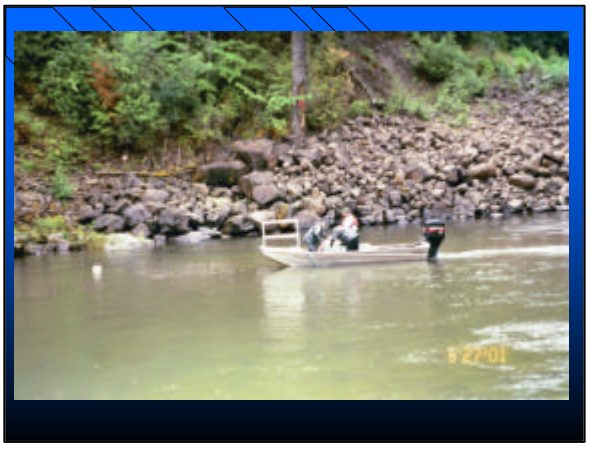


Figure 6

Figure 7

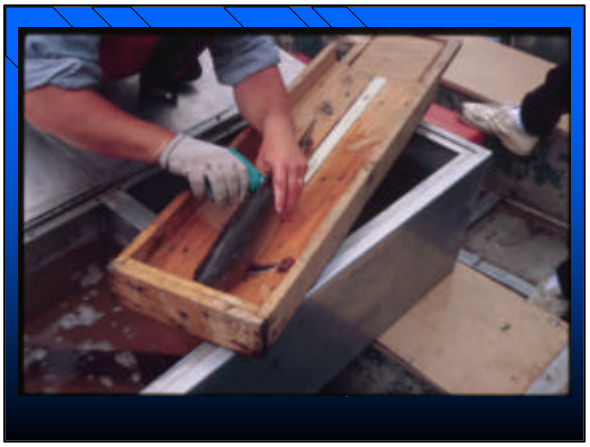


Figure 8

Figure 9

Figure 10

Figure 11

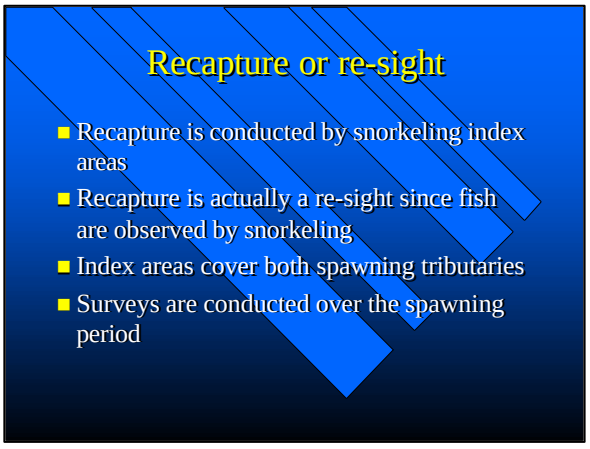


Figure 12

Figure 13

What population are we monitoring?

- Tagging adults staging to spawn
- Used length-frequency data to eliminate immature fish
- Used radio-tag data to correct for non-migrants
- Our population estimate is the annual population staging to spawn
- If pre-spawn or fishing mortality occurs then these estimates must be subtracted from the population estimate to obtain the spawning escapement

Figure 14

Noremark –joint hypergeometric (JHE) maximum likelihood estimator

$$\langle (N \mid M, n_i, m_i) \rangle \prod_{i=1}^{k} \frac{\binom{M}{m_i}\binom{N-M}{n_i-m_i}}{\binom{N}{n_i}} \qquad (1)$$

- M_i = Number of tagged bull trout in the population that are in the survey area surveyed at the time of the i^{th} sighting survey.
- n_i = Number of bull trout seen during the i^{th} sighting survey.
- m_i =Total number of sightings of marked bull trout.

Figure 15

JHE is a pooled Petersen Estimate

N = (C)*(M)/(R)

N is the population size,

M is the number of marked fish released,

R is the number of marked fish re-sighted from all surveys, and

C is the total number of fish re-sighted from all surveys.

Figure 16

Assumptions of the Petersen Estimator

- Closure;
- No mark loss;
- All marked fish are properly recognized;
- Marking has no effect on catchability;
- All fish have the same probability of being tagged in the first sample or of being captured in the second sample.

Figure 17

Closure

- Implies no immigration or emigration
- Still valid if mortality rate is equal for marked and unmarked animals
- Emigration and mortality of marked bull trout was ~ 6% based on radio-tagging in 1992
- All bull trout less than 37cm are non-migrants based on gill netting near spawning grounds
- Initial capture has been moved from headwaters of the reservoir to the river to capture actively migrating fish

Figure 18

Mark Loss

Location	Species	Tag	Tag Loss	Study
Willamette R.	Spring Chinook	Floy (HD)	1%	Kenaston et al. (1999)
Wind R	Summer Steelhead	Floy	3%	Rawding et al. 2001
Wind R	Summer Steelhead	Floy	4%	Rawding et al. 2001
Willamette R.	Spring Chinook	Floy(Flag)	6%	Kenaston et al. (1999)
Kuparuk R.	Arctic Grayling	Floy	6%	Buzby &Deegan1999
Cedar C.	Fall Chinook	Floy	10%	WDFW, unpublished
Elochoman R.	Fall Chinook	Floy	25%	WDFW, unpublished
Black C.	Coho	Floy	30%	Irvine et al. 1993

- Radio tagged bull trout had 100% tag retention
- Fish captured 1 year later showed tag loss
- Best guesstimate is 3-4% tag loss

Figure 19

All marked fish are properly recognized

- Visible Floy tags inserted at the base of the dorsal fin
- Tags are treated with algae fungicide, so they remain visible
- Snorkelers look down on bull trout
- Snorkelers classify fish as unknown if they don't get a good look at the dorsal area
- Unknown fish are not included in the population calculations

Figure 20

All fish have the same probability of tagged in the first sample or of being captured in the second sample

- Tag of the entire spawning run
- Snorkel over the entire spawning period
- Snorkel both Pine and Rush creek

Figure 21

Sample over the entire spawning time

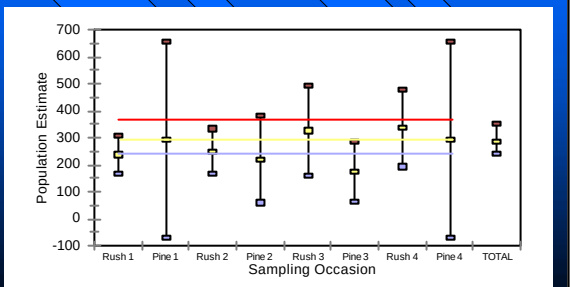


Figure 22

Sample both spawning tributaries

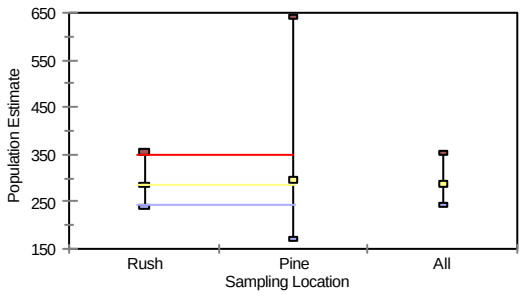


Figure 23

Length Frequency of Initial Captures in 2000

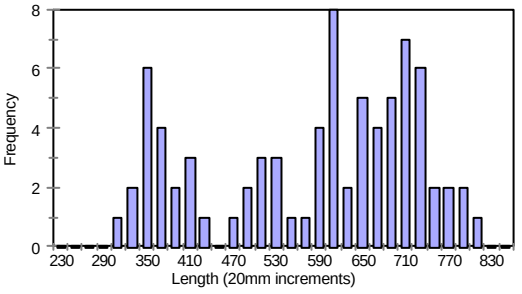


Figure 24

Results

- Fish captured by year
- Size trend by year
- Population estimate over time
- Population trend

Figure 25

Captures by Year

Year	Timeframe	# Tagged	# Captured	# Recaptured	# Capture Mortalities
2001	May 24-July 12	88	126	28	0
2000	May 18-July 13	69	87	16	1
1999	May 27-July 15	32	36	3	0
1998	May 07-June 11	58	67	14	0
1997	May 08-June 26	56	75	20	1
1996	May 10-June 18	15	18	2	1
1995	May 09-May 25	46	48	2	0

Figure 26

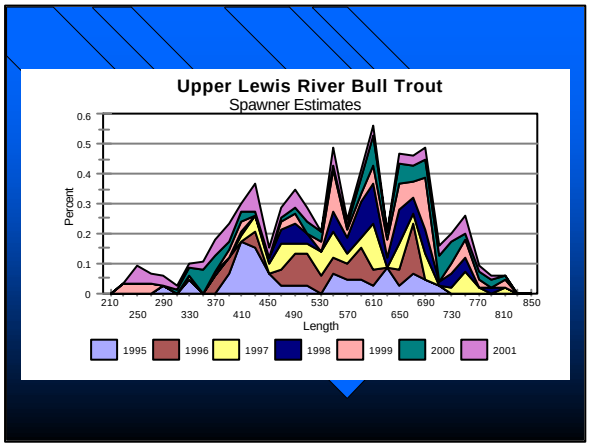


Figure 27

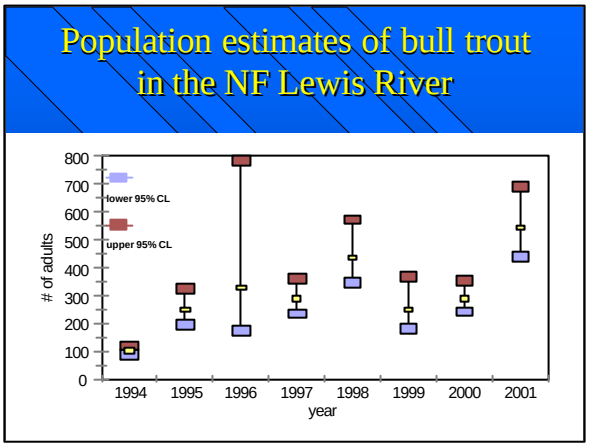


Figure 28

Future Investigations

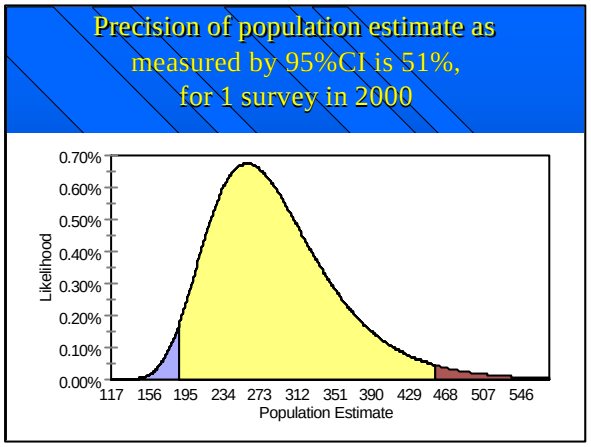
- Maintain and/or improve precision of population estimates
- Estimate juvenile outmigration and timing into reservoir using a screw trap
- Pit tag adults and juveniles for accurate age and spawn information
- Small stream flat plate technology

Figure 29

Precision of Estimates

- Robson and Reiger (1964) recommended 95% Confidence Intervals of +/-25% for management and +/- 10% for research
- 95% CI for NF Lewis spawners has ranged from 16% to 37% (avg. 24%) for 7 of the 8 years

Figure 30



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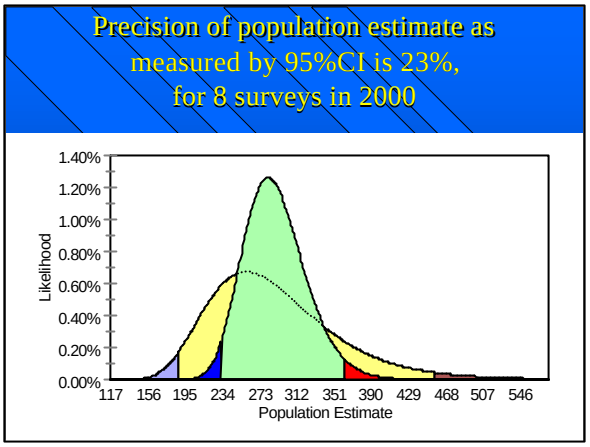
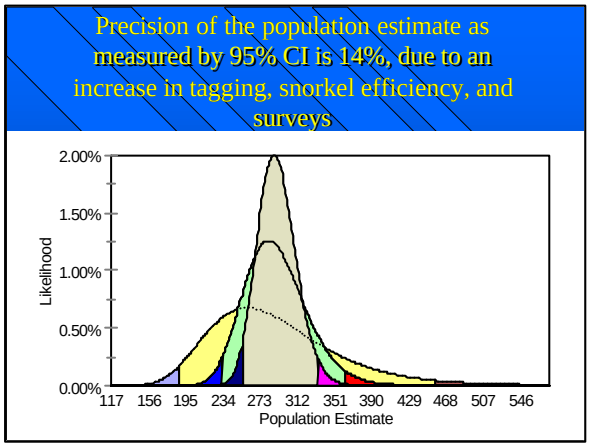


Figure 32



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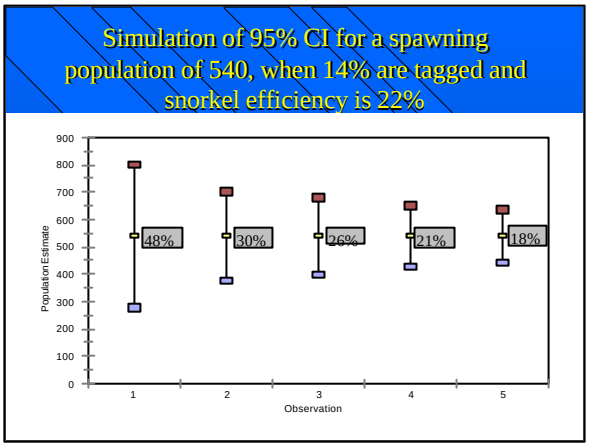

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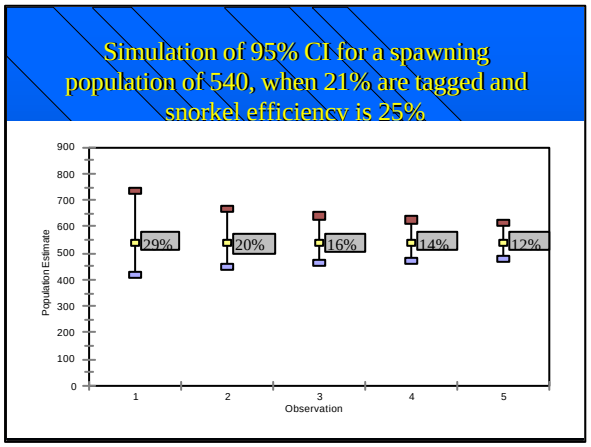

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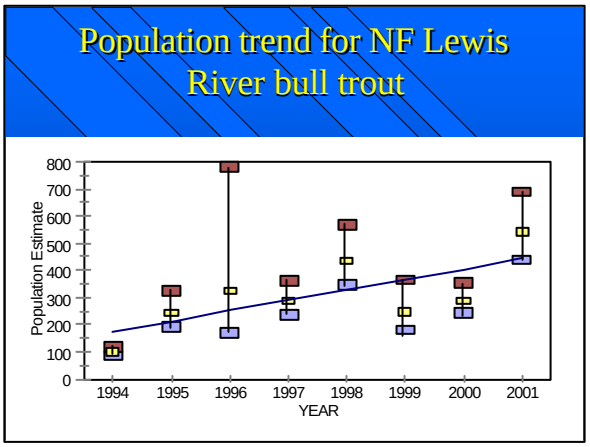

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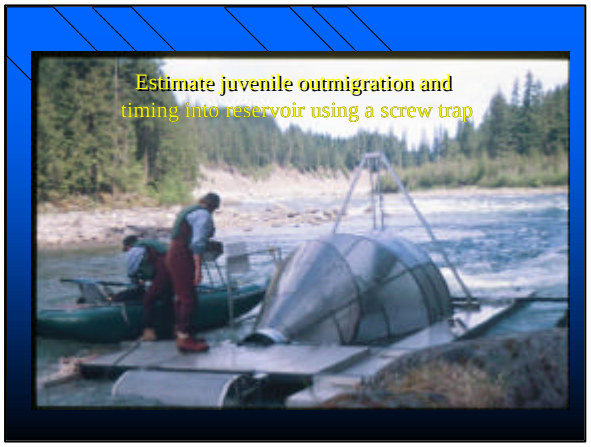

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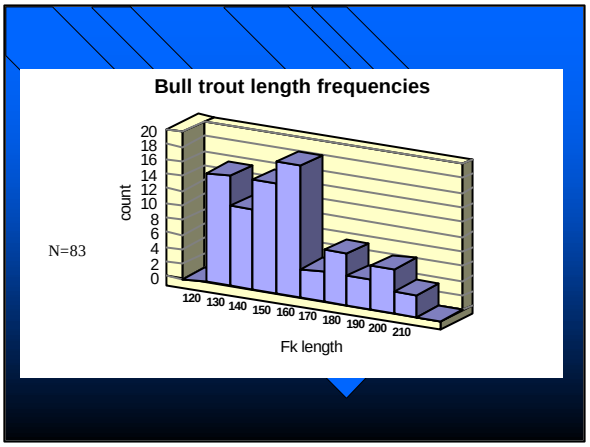

Figure 38

Figure 39

Figure 40

Figure 41

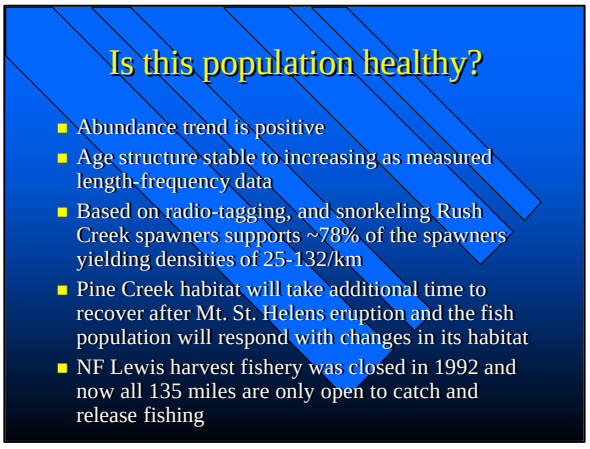

Figure 42